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SEA ICE IN LÜTZOW-HOLM BAY (II)— ITS STRUCTURE AND GROWTH PROCESSES— (ABSTRACT)

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As part of the Antarctic Climate Research (ACR) program, a two-year study of atmosphere/sea-ice/ocean interaction was conducted off Queen Maud-Enderby Lands, Antarctica, in 1990 and 1991. Research on the spatial characteristics of snow depth and sea-ice thickness and on the growth processes of sea ice was carried out in Lützow-Holm Bay. The lengths of snow stakes, snow depths and sea-ice thicknesses were all measured at ten offshore stations on two latitudinal lines in April, August and October of both years. Sea ice cores were also collected to assess structure, temperature, salinity and oxygen isotope concentration.

Spatial variations of snow depth and sea ice thickness were clearly noticed. The stations near the Antarctic Continent have little snow cover. However, the snow depth increased consistently with distance from the Continent, reaching a nearly constant maximum value of 1 to 1.5 m during the winter. The increase of ice thickness paralleled that of snow depth, the maximum thickness at the offshore stations being 2 to 3 m. At stations with little snow cover, the sea ice grew in the austral winter months and decayed in summer to the thickness of the previous year. In contrast, in heavily snow-covered regions, the sea ice showed little growth even in winter, because the thick snow cover and sea ice itself reduced the vertical heat flux and accordingly the growth rate due to bottom freezing. In summer, however, an extreme increase of sea ice thickness of 0.5 to 1 m was observed. The growth is believed to be caused by refreezing of low-salinity meltwater from the snow cover, for the following reasons. a) The changes in the lengths of snow stakes and snow depth show that snow cover near the sea ice surface are transferred into the ice layer. b) The structure of the upper sea ice is quite similar to that of fresh water ice. c) The oxygen isotope concentration of the upper sea ice is close to that of the snow cover, suggesting snow-cover origin. d) An aquifer about 0.2 m deep was found to exist on the snow/ice interface in January, 1992.

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